Realistic laboratory curing of bituminous mixtures

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Main objectives

- Describe physico-chemical phenomena involved in the thermal ageing
- Highlight existing gaps in Swiss and European standardisation
- Improve repeatability and reproducibility of the tests
- Obtain results in conditions comparable to asphalt mixing plant
- Develop a new reheating methodology adapted to road laboratories

Experimental study

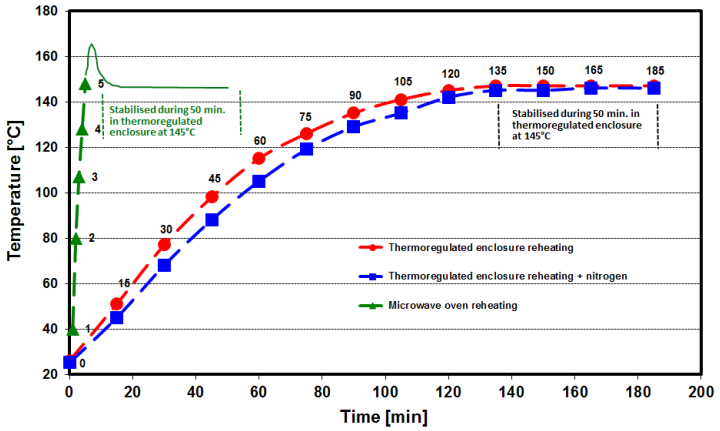

Figure 1: Reheating procedures

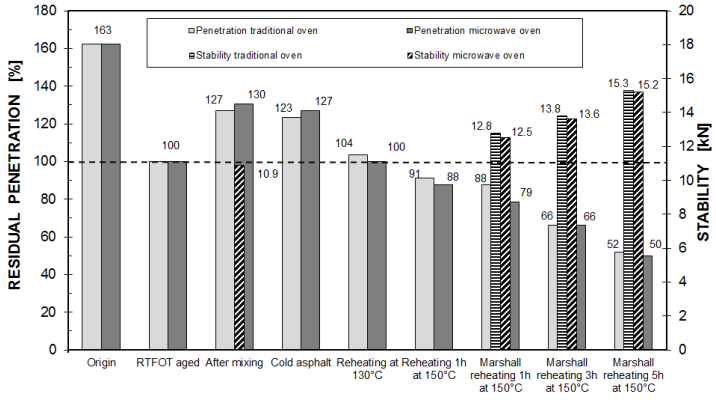

Figure 2: Reheating impact comparison. AB 11S, B80/100 Cressier

Conduct of the study

Exploratory study

- Influence of parameters on thermal ageing
- Conditions of use of the microwave oven
- Reheating procedures comparison

Deepening and calibration study

- Detailed study of certain reheating procedures
- Asphalt ageing under nitrogen atmosphere
- Thermal ageing rate control and reheating procedures optimisation
- Proposal for a new reheating methodology

Testing and validation phase

- Validation of the reheating methodology
- Recommendations for standards development

New reheating methodology

1. Identify bitumen in the mix
2. Define the mix design compaction temperature with standard SN 670428, EN 12697-8, With polymer-modified bitumen or bitumen with addition, refer to the manufacturer's prescriptions or customer's requirements
3. For small specimens (cores …), start with a 30 seconds sequence
4. For large specimens, for example 18 kilograms packaging, reheat specimen with microwave oven up to about the quarter separation temperature according to the following procedure :
   - Reheat bituminous mixture up to about 100°C (1st sequence, 4 minutes). At maximum power (3300 W), temperature increases about 10 to 15°C per minute, depending on treated materials
   - Reheat minute by minute, with temperature control after each sequence
   - If necessary, rehomogenise the material and change the packaging position, to prevent any risk of local overheating
5. Quarter separation for test preparation
6. If temperature decrease is very important after quarter separation, continue microwave oven reheating up to the compaction temperature
7. Maintain bituminous mixture, placed in a receptacle with a cover, in a thermoregulated enclosure during 40 minutes (for the 1st Marshall sample), 60 minutes (4th Marshall sample), 50 minutes for the other samples at compaction temperature with a setpoint temperature higher than the compaction temperature (+5°C)
8. By test or by series of tests, process with a maximum of 3 packaging (form 15 to 18 kilograms) to guarantee an adequate level of ageing homogenisation

References

- Prof. Dumont A.-G., Pittet M., Vieillissement thermique des enrobés bitumineux en laboratoire, Mandat de recherche VSS 2000/434, 2012.
- Pittet M., Angst Ch., Récupération du liant provenant d'extraction – Mise en application et adaptation de la nouvelle norme européenne vis-à-vis des expériences suisses, Mandat de recherche VSS 1999/122, 2002.